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(54) **METHOD AND SYSTEM FOR PROPAGATING A CLIENT IDENTITY**

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G06F 21/10	(2013.01)
H04L 29/06	(2006.01)

(52) **U.S. Cl.**
CPC ***H04L 9/3247*** (2013.01); ***H04L 63/0807*** (2013.01); ***H04L 63/126*** (2013.01); *G06F 21/10* (2013.01); *H04L 63/0823* (2013.01); *H04L 63/168* (2013.01); *H04L 63/20* (2013.01); *H04L 2209/56* (2013.01)

(58) **Field of Classification Search**
CPC combination set(s) only.
See application file for complete search history.

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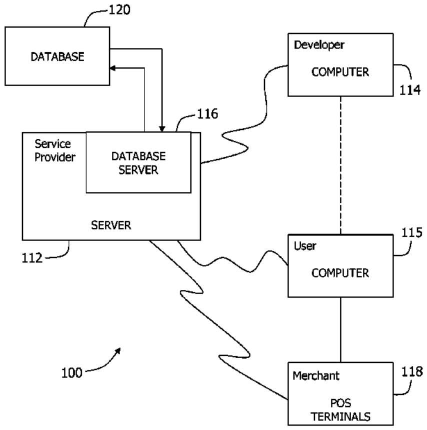
(57) **ABSTRACT**

A method and system for securely propagating client identities in a service call from a first system to a target service system are provided. The system includes a memory device for storing data and a service provider (SP) computer system. The SP computer system is programmed to determine identities to transmit to the target system in association with a request, construct a data structure to represent each identity and additional information related to the identity, digitally sign the identity information, pair the identity information and the corresponding digital signature in a header of a request message from the first system to the target service system, receive the request message and extract the identity information and corresponding digital signatures from the header, validate the corresponding digital signatures, and construct using the corresponding identity information a data structure that represents each of the original identities established in the first system.

32 Claims, 6 Drawing Sheets



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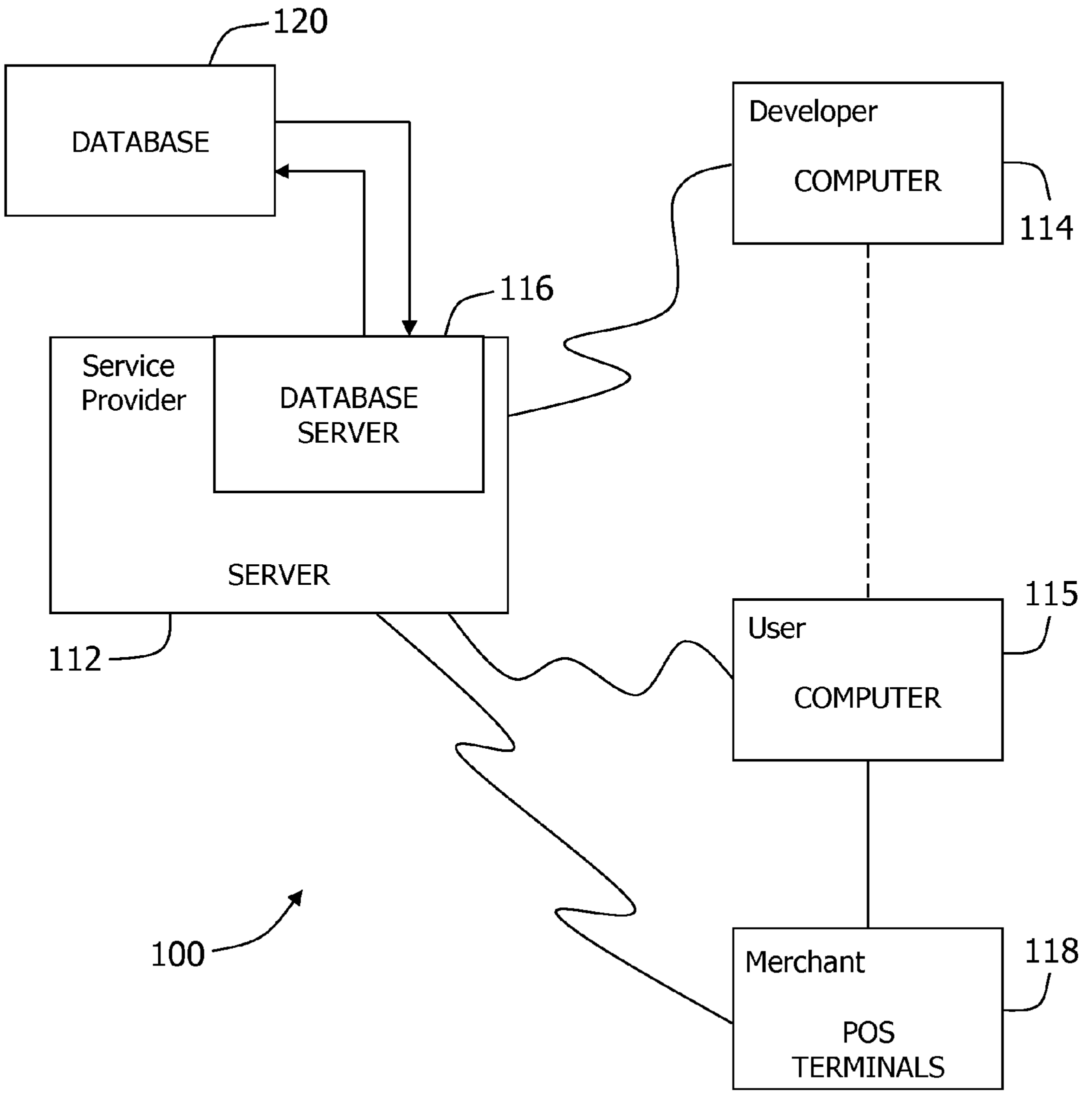
120
DATABASE
Developer
COMPUTER
114
116
Service Provider
DATABASE SERVER
SERVER
112
115
User
COMPUTER
100
118
Merchant
POS TERMINALS

FIG. 1

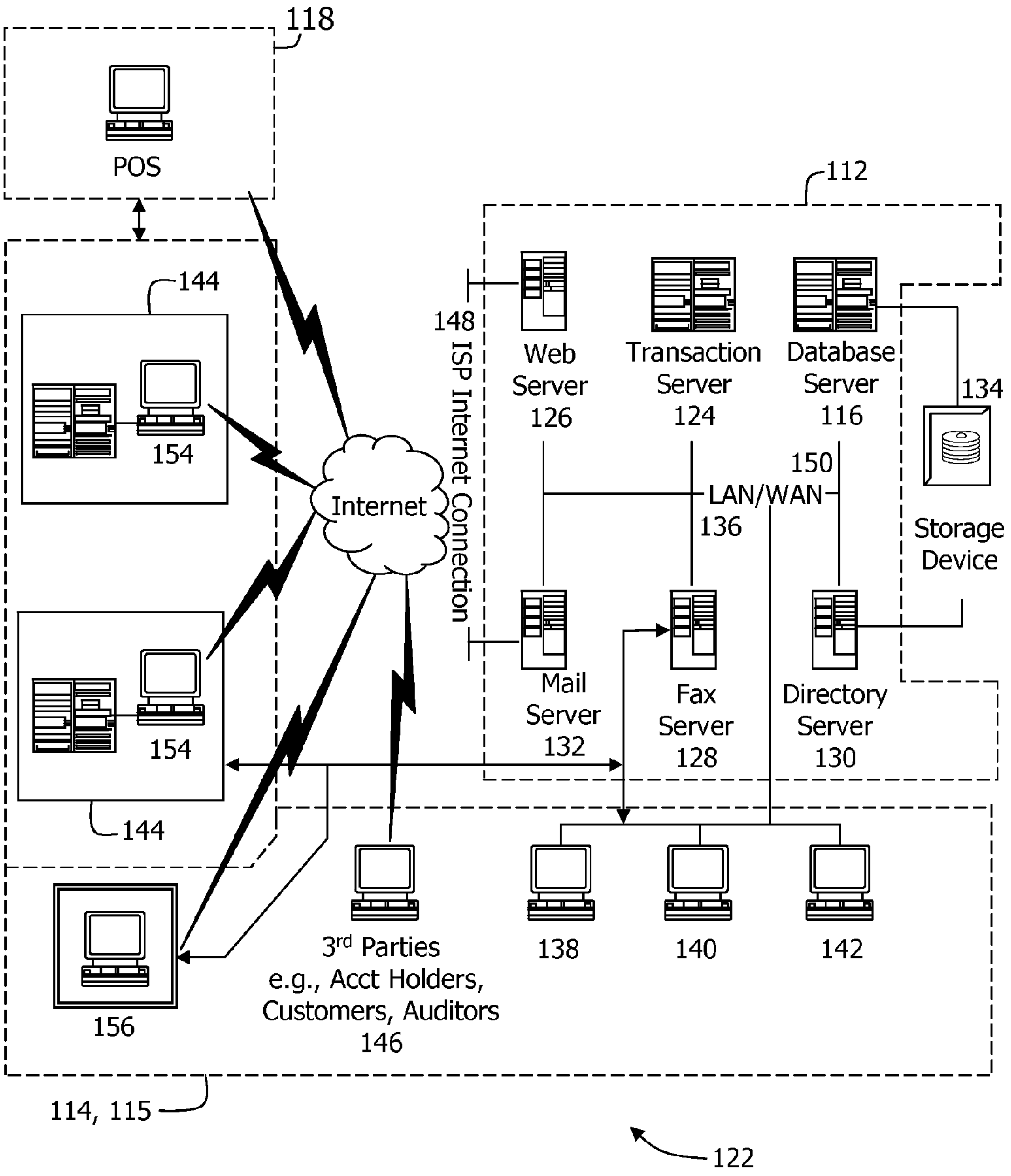
118
POS
112
144
148
ISP Internet Connection
Web Server 126
Transaction Server 124
Database Server 116
134
154
150
Internet
LAN/WAN
136
Storage Device
Mail Server 132
Fax Server 128
Directory Server 130
154
144
3rd Parties e.g., Acct Holders, Customers, Auditors 146
138
140
142
156
114, 115
122

FIG. 2

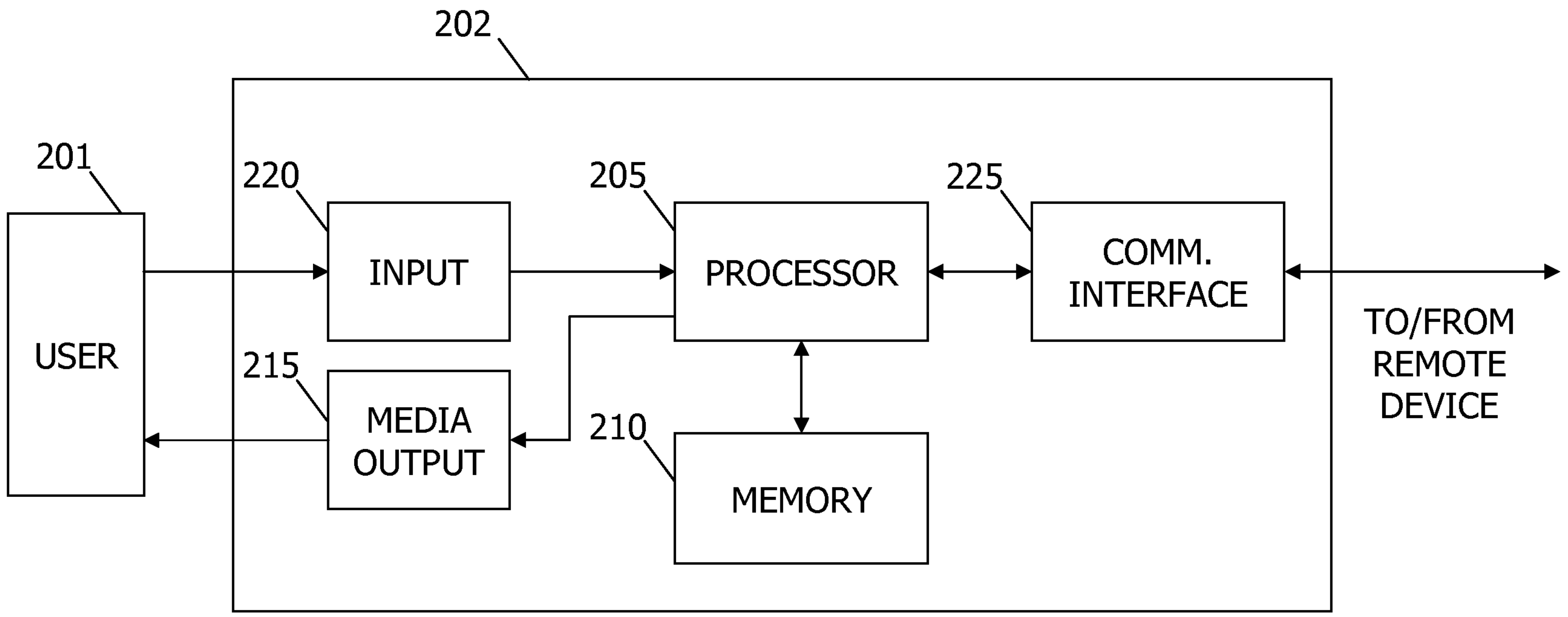
202
201
USER
220
INPUT
215
MEDIA OUTPUT
205
PROCESSOR
210
MEMORY
225
COMM. INTERFACE
TO/FROM REMOTE DEVICE

FIG. 3

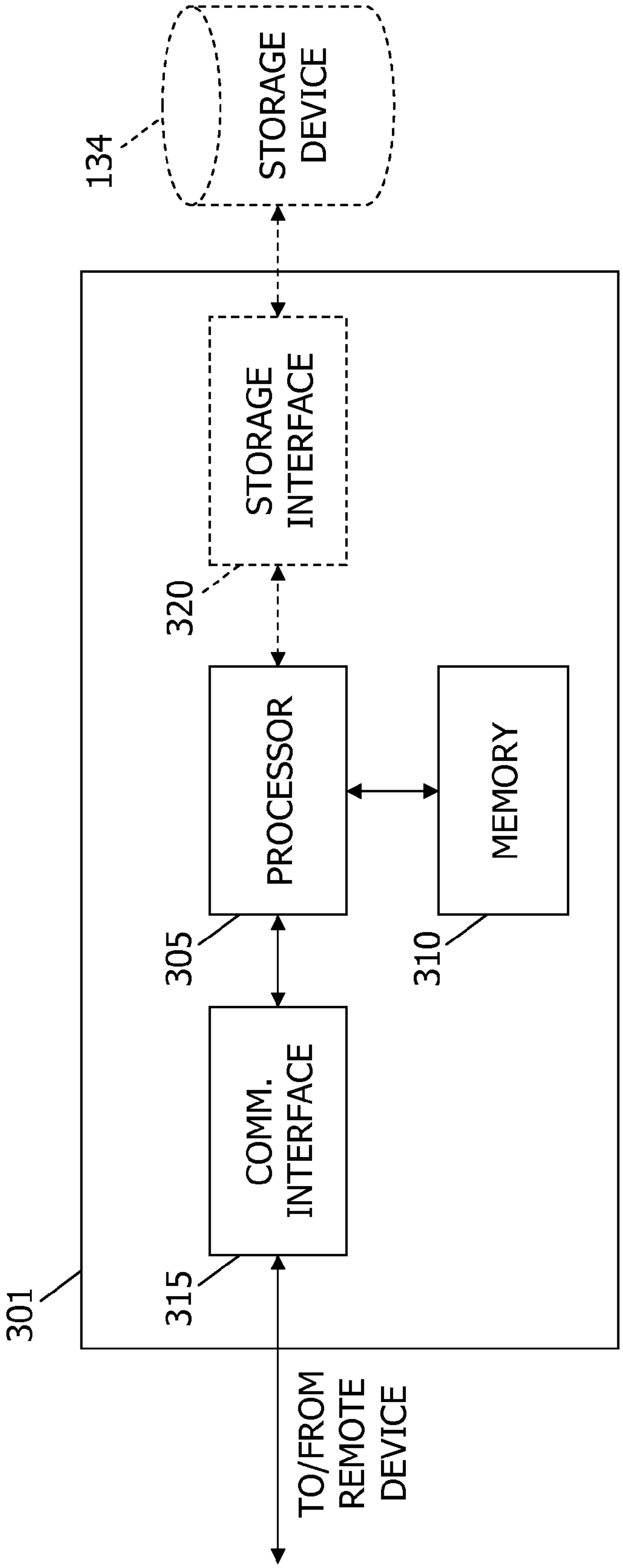
134
STORAGE DEVICE
320
STORAGE INTERFACE
305
PROCESSOR
310
MEMORY
315
COMM. INTERFACE
301
TO/FROM REMOTE DEVICE

FIG. 4

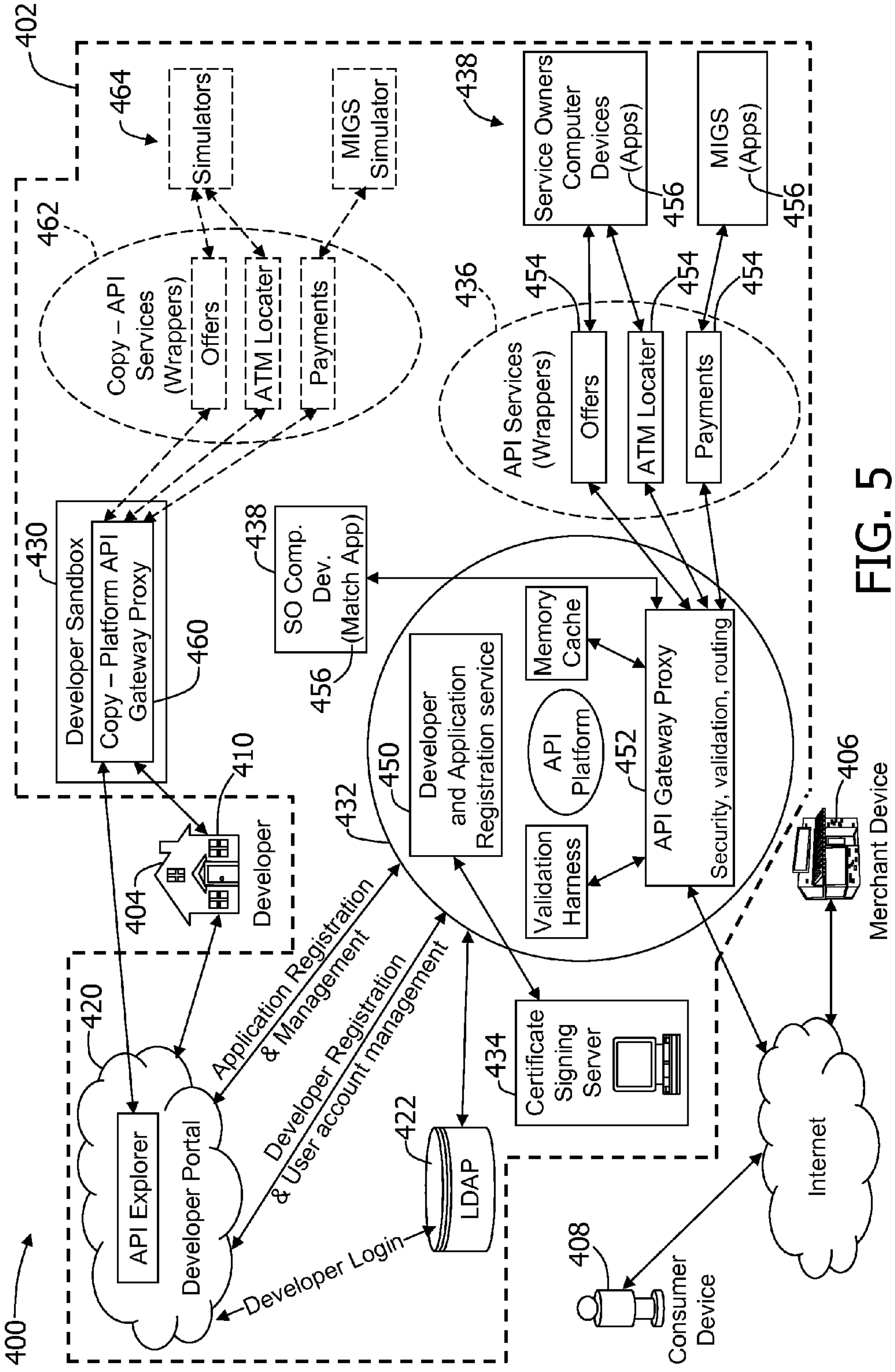
400
402
Developer Portal
API Explorer
420
LDAP
422
Developer Login
Developer Registration & User account management
Application Registration & Management
Developer
404
410
Developer Sandbox
430
Copy – Platform API Gateway Proxy
460
Copy – API Services (Wrappers)
Offers
ATM Locater
Payments
462
Simulators
464
MIGS Simulator
SO Comp. Dev. (Match App)
438
456
432
Developer and Application Registration service
450
API Platform
452
Memory Cache
Validation Harness
API Gateway Proxy
Security, validation, routing
Certificate Signing Server
434
API Services (Wrappers)
436
Offers
ATM Locater
Payments
454
454
454
Service Owners Computer Devices (Apps)
456
MIGS (Apps)
456
438
Internet
Consumer Device
408
Merchant Device
406

FIG. 5

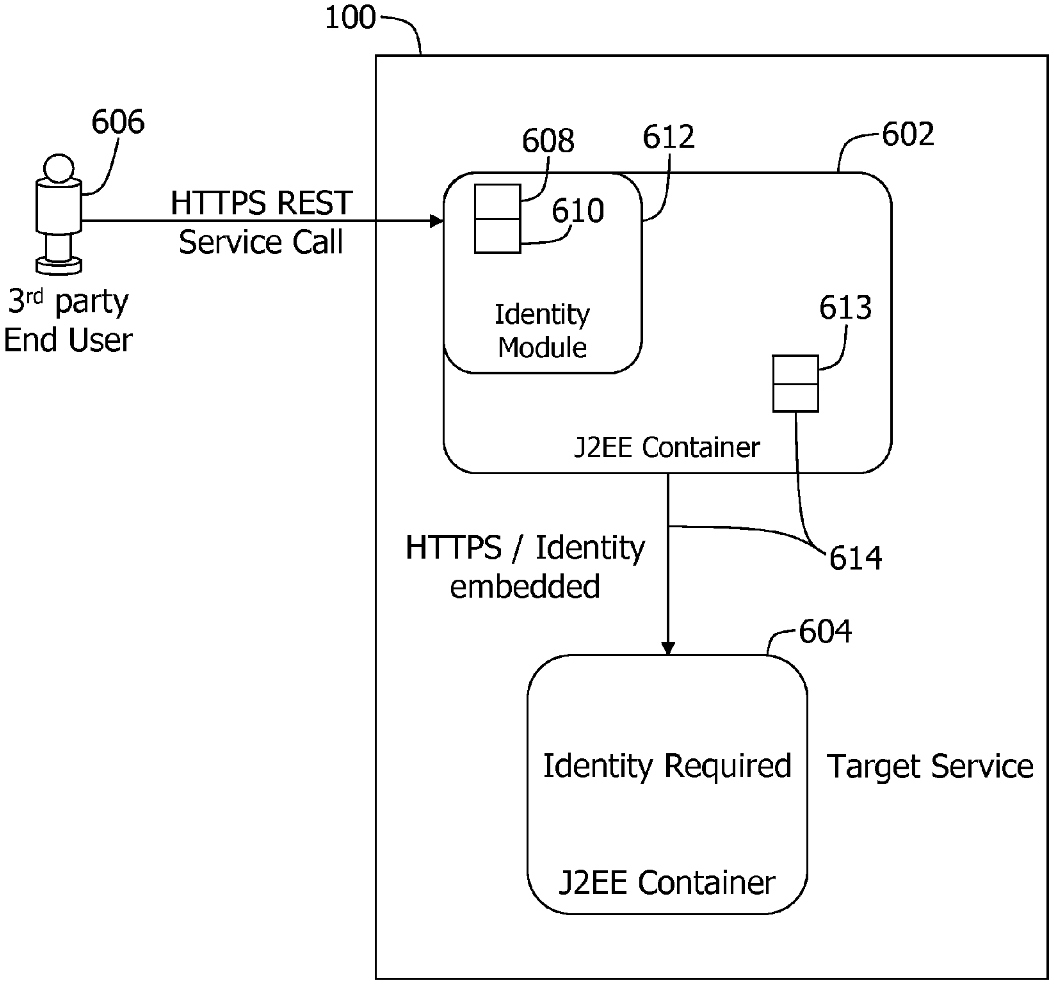
100
606
3rd party
End User
HTTPS REST
Service Call
608
612
602
610
Identity
Module
613
J2EE Container
HTTPS / Identity
embedded
614
604
Identity Required
Target Service
J2EE Container

FIG. 6

METHOD AND SYSTEM FOR PROPAGATING A CLIENT IDENTITY

CROSS REFERENCE TO RELATED APPLICATIONS

This patent application claims priority to U.S. Provisional Patent Application Ser. No. 61/430,850, filed on Jan. 7, 2011, which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

This invention relates generally to providing access to a computer system through an open application programming interface (API) and, more particularly, to network-based methods and systems for propagating a client identity in a service call from a gateway system to a target service system.

There are service provider companies that provide a variety of services to numerous consumers. These service provider companies utilize computer systems to provide these services. For example, in the financial industry, companies such as large banks, interchange networks and payment networks provide certain financial services to consumers, companies and other banks. Oftentimes, these service provider companies provide services that include receiving, processing and storing financial data in computer systems managed by the service provider companies. In many cases, access to this financial data is restricted to certain approved users. Restricting access to such financial data provides at least some protection for the data. However, it also limits the potential uses of the data.

Software developers around the world are able to develop computer programs, sometimes called applications, which are configured to utilize data such as the data stored within computer systems used by certain service provider companies. Of course, in order for these computer programs to use such data, the developer programs must be able to access the data and be able to request the data in a proper format. One way to access the data stored by these service provider companies is through an open application programming interface (API).

By allowing software developers to access data stored within computer system used by these service provider companies, the service provider companies are able to leverage these developer applications as well as increase their transaction volume. Thus, by providing this data access to developers, these service provider companies are able to provide additional services to both existing and new customers, which in turn improves the profitability of these companies. However, the providing of such data access also creates certain risks and challenges for the service provider companies.

Accordingly, it would be desirable to provide a computer system having an open API that could be used by certain service provider companies, such as financial transaction companies, that is configured to: (i) propagate a client identity in a service call from a gateway system to a target service system in a service provider (SP) computer system; (ii) provide to a service system security authorization for the identity for each request message requesting services; and (iii), and provide client profile information to the service system to permit additional features to be incorporated into the response.

BRIEF DESCRIPTION OF THE INVENTION

In one embodiment, a computer system for propagating a client identity in a service call from a first system to a target service system in a service provider (SP) computer system for an API service application stored within a service owner (SO) computer device includes a memory device for storing data and a service provider (SP) computer system including a processor and an open application programming interface (API) platform, the SP computer system in communication with the memory device and the SO computer device. The SP computer system is programmed to receive a message defining an API service request including at least a header portion and a payload portion, determine at the first system an identity of an application transmitting the received message using identity information contained in the header portion that has already been established within the first system, digitally sign the identity information wherein information used in the digital signature is pre-established with the service system, pair the identity information and the corresponding digital signature in a header of a request message to be transmitted from the first system to the service system, receive by the service system the request message and extracting the identity information and corresponding digital signature from the header, validate by the service system the corresponding digital signature, and for signatures that are successfully validated, construct using the corresponding identity information a data structure that represents the original identity established in the first system.

In another embodiment, a computer-implemented method of propagating a client identity in a service call from a gateway system to a target service system in a service provider (SP) computer system includes receiving a message defining an API service request including at least a header portion and a payload portion, determining at the gateway system an identity of an application transmitting the received message using identity information contained in the header portion that has already been established within the gateway system, digitally signing the identity information wherein information used in the digital signature is pre-established with the service system, pairing the identity information and the corresponding digital signature in a header of a request message to be transmitted from the gateway system to the service system, receiving by the service system the request message and extract the identity information and corresponding digital signature from the header, validating by the service system the corresponding digital signature, and for signatures that are successfully validated, constructing using the corresponding identity information a data structure that represents the original identity established in the gateway system.

In yet another embodiment, one or more computer-readable non-transitory media includes a computer-executable program that instructs at least one processor to propagate a client identity in a service call from a first system to a target service system for an API service application stored within a service provider (SP) computer system through an open application programming interface (API) platform. The computer-executable program includes at least one code segment that instructs the at least one processor to receive a message defining an API service request including at least a header portion and a payload portion, determine at the first system an identity of an application transmitting the received message using identity information contained in the header portion that has already been established within the first system, digitally sign the identity information wherein information used in the digital signature is pre-established with the service system, pair the identity information and the corresponding digital signature in a header of a request message to be transmitted from the first system to the service system, receive by the service system the request message and extract the identity information and corresponding digital signature from the header, validate by the service system the corresponding digital signature, and for signatures that are successfully validated, construct using the corresponding identity information a data structure that represents the original identity established in the first system.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**-**6** show exemplary embodiments of the method and system described herein.

FIG. **1** is a simplified block diagram of an exemplary service system including a plurality of computer devices in accordance with one embodiment of the present invention.

FIG. **2** is an expanded block diagram of an exemplary embodiment of a server architecture of the service system including the plurality of computer devices in accordance with one embodiment of the present invention.

FIG. **3** is a block diagram of an exemplary embodiment of a user computer device as shown in FIGS. **1** and **2**.

FIG. **4** is a block diagram of an exemplary embodiment of a server computer device as shown in FIGS. **1** and **2**.

FIG. **5** is a more detailed block diagram of an exemplary configuration of the service provider computer system in communication with other computer devices as shown in FIGS. **1** and **2**.

FIG. **6** is a schematic block data flow diagram illustrating a Hypertext Transfer Protocol Secure (HTTPS) Representational State Transfer (REST) service call in accordance with an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The following detailed description illustrates embodiments of the invention by way of example and not by way of limitation. The description clearly enables one skilled in the art to make and use the disclosure, describes several embodiments, adaptations, variations, alternatives, and uses of the disclosure, including what is presently believed to be the best mode of carrying out the disclosure. The disclosure is described as applied to an exemplary embodiment, namely, systems and methods of generating properly formatted API service request messages. However, it is contemplated that this disclosure has general application to computing systems in industrial, commercial, and residential applications.

As used herein, an element or step recited in the singular and preceded with the word "a" or "an" should be understood as not excluding plural elements or steps, unless such exclusion is explicitly recited. Furthermore, references to "one embodiment" of the present invention are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features.

Embodiments of the present invention described herein relate to propagation of one or more identities (system, user, etc.), authorization information related to each identity, and miscellaneous data associated with each identity between two applications using, for example, but not limited to the HTTP protocol in a manner that is independent of the HTTP request payload. This process is used to propagate the desired identity information to an unlimited number of downstream applications.

FIG. **1** is a simplified block diagram of an exemplary service system **100** including a plurality of computer devices in accordance with one embodiment of the present invention. System **100** includes a service provider system (e.g., financial services provider) that allows developers of computer applications to access a variety of service applications hosted by the service provider (SP) computer system such that the developer applications can utilize data stored within the SP computer system. The developer applications can be utilized by the developer via a developer computer system or can be offered to a consumer, a merchant, an acquirer or an issuer (collectively a "user") for use by the users via user computer systems.

More specifically, in the example embodiment, system **100** includes a server system **112**, which is a type of computer system, and a plurality of client sub-systems (also referred to as client systems **114** and **115**) connected to server system **112**. In one embodiment, client systems **114**, **115** are computers including a web browser, such that server system **112** is accessible to client systems **114**, **115** using the Internet. Client systems **114**, **115** are interconnected to the Internet through many interfaces including a network, such as a local area network (LAN) or a wide area network (WAN), dial-in-connections, cable modems, and special high-speed ISDN lines. Client systems **114**, **115** could be any device capable of interconnecting to the Internet including a web-based phone, personal digital assistant (PDA), or other web-based connectable equipment.

System **100** also includes point-of-sale (POS) terminals **118**, which may be connected to client systems **114**, **115** and may be connected to server system **112**. POS terminals **118** are interconnected to the Internet through many interfaces including a network, such as a local area network (LAN) or a wide area network (WAN), dial-in-connections, cable modems, wireless modems, and special high-speed ISDN lines. POS terminals **118** could be any device capable of interconnecting to the Internet and including an input device capable of reading information from a consumer's financial transaction card.

A database server **116** is connected to database **120**, which contains information on a variety of matters, as described below in greater detail. In one embodiment, centralized database **120** is stored on server system **112** and can be accessed by potential users at one of client systems **114**, **115** by logging onto server system **112** through one of client systems **114**, **115**. In an alternative embodiment, database **120** is stored remotely from server system **112** and may be non-centralized.

Database **120** may store transaction data generated as part of sales activities conducted over the services network including data relating to merchants, account holders or customers, developers, issuers, acquirers, purchases made, and services provided by system **100**. Database **120** may also store account data including at least one of a cardholder name, a cardholder address, an account number, and other account identifier. Database **120** may also store merchant data including a merchant identifier that identifies each merchant registered to use the network, and instructions for settling transactions including merchant bank account information. Database **120** may also store purchase data associated with items being purchased by a cardholder from a merchant, and authorization request data.

In the example embodiment, client system **114** may be associated with a developer of computer applications and may be referred to as a developer computer device, and client system **115** may be associated with a consumer, an acquirer or an issuer and may be referred to as a user computer device. Developer computer device **114** stores developer applications that a user may access and utilize via user computer device **115**. Server system **112** may be associated with a service provider (SP) and maybe referred to as a SP computer device. In the example embodiment, an SP may include a payment network provider, an interchange network provider, or any other provider of financial services.

In the embodiment where the SP is an interchange network provider, system **100** includes POS terminals **118**, which may be associated with a merchant. In this embodiment, system **100** may be part of a multi-party payment card industry system for enabling ordinary payment-by-card transactions such as a credit card payment system using the MasterCard® interchange. The MasterCard® interchange is a proprietary communications standard promulgated by MasterCard International Incorporated® for the exchange of financial transaction data between financial institutions that are members of MasterCard International Incorporated®. (MasterCard is a registered trademark of MasterCard International Incorporated located in Purchase, N.Y.).

For example, in a typical payment card system, a financial institution called the "issuer" issues a payment card, such as a credit card, to a consumer, who uses the payment card to tender payment for a purchase from a merchant. To accept payment with the payment card, the merchant must normally establish an account with a financial institution that is part of the financial payment system. This financial institution is usually called the "merchant bank" or the "acquiring bank" or "acquirer bank." When a consumer tenders payment for a purchase with a payment card (also known as a financial transaction card), the merchant requests authorization from the merchant bank for the amount of the purchase. The request may be performed over the telephone, but is usually performed through the use of a point-of-sale terminal, which reads the consumer's account information from the magnetic stripe on the payment card and communicates electronically with the transaction processing computers of the merchant bank. Alternatively, a merchant bank may authorize a third party to perform transaction processing on its behalf. In this case, the point-of-sale terminal will be configured to communicate with the third party. Such a third party is usually called a "merchant processor" or an "acquiring processor."

Using the interchange network, the computers of the merchant bank or the merchant processor will communicate with the computers of the issuer bank to determine whether the consumer's account is in good standing and whether the purchase is covered by the consumer's available credit line. Based on these determinations, the request for authorization will be declined or accepted. If the request is accepted, an authorization code is issued to the merchant.

When a request for authorization is accepted, the available credit line of consumer's account is decreased. Normally, a charge is not posted immediately to a consumer's account because bankcard associations, such as MasterCard International Incorporated®, have promulgated rules that do not allow a merchant to charge, or "capture," a transaction until goods are shipped or services are delivered. When a merchant ships or delivers the goods or services, the merchant captures the transaction by, for example, appropriate data entry procedures on the point-of-sale terminal. If a consumer cancels a transaction before it is captured, a "void" is generated. If a consumer returns goods after the transaction has been captured, a "credit" is generated.

For debit card transactions, when a request for a PIN authorization is approved by the issuer, the consumer's account is decreased. Normally, a charge is posted immediately to a consumer's account. The bankcard association then transmits the approval to the acquiring processor for distribution of goods/services, or information or cash in the case of an ATM.

After a transaction is captured, the transaction is settled between the merchant, the merchant bank, and the issuer. Settlement refers to the transfer of financial data or funds between the merchant's account, the merchant bank, and the issuer related to the transaction. Usually, transactions are captured and accumulated into a "batch," which is settled as a group.

The financial transaction cards or payment cards discussed herein may include credit cards, debit cards, a charge card, a membership card, a promotional card, prepaid cards, and gift cards. These cards can all be used as a method of payment for performing a transaction. As described herein, the term "financial transaction card" or "payment card" includes cards such as credit cards, debit cards, and prepaid cards, but also includes any other devices that may hold payment account information, such as mobile phones, personal digital assistants (PDAs), and key fobs.

Although the SP has been described herein as an interchange network provider, it does not have to be so limited. As indicated above, the SP may also be a payment network provider or any other provider of financial services. In these embodiments, a transaction card, a payment or even a purchase are not necessarily needed to utilize the services provided by the SP.

FIG. **2** is an expanded block diagram of an exemplary embodiment of a server architecture of a service system **122** including other computer devices in accordance with one embodiment of the present invention. Components in system **122**, identical to components of system **100** (shown in FIG. **1**), are identified in FIG. **2** using the same reference numerals as used in FIG. **1**. System **122** includes server system **112**, client systems **114** and **115**, and POS terminals **118**. Server system **112** further includes database server **116**, a transaction server **124**, a web server **126**, a fax server **128**, a directory server **130**, and a mail server **132**. A storage device **134** is coupled to database server **116** and directory server **130**. Servers **116**, **124**, **126**, **128**, **130**, and **132** are coupled in a local area network (LAN) **136**. In addition, a system administrator's workstation **138**, a user workstation **140**, and a supervisor's workstation **142** are coupled to LAN **136**. Alternatively, workstations **138**, **140**, and **142** are coupled to LAN **136** using an Internet link or are connected through an Intranet.

Each workstation, **138**, **140**, and **142** is a personal computer having a web browser. Although the functions performed at the workstations typically are illustrated as being performed at respective workstations **138**, **140**, and **142**, such functions can be performed at one of many personal computers coupled to LAN **136**. Workstations **138**, **140**, and **142** are illustrated as being associated with separate functions only to facilitate an understanding of the different types of functions that can be performed by individuals having access to LAN **136**.

Server system **112** is configured to be communicatively coupled to various individuals, including employees **144** and to third parties, e.g., account holders, customers, auditors, developers, consumers, merchants, acquirers, issuers, etc., **146** using an ISP Internet connection **148**. The communication in the exemplary embodiment is illustrated as being performed using the Internet, however, any other wide area network (WAN) type communication can be utilized in other embodiments, i.e., the systems and processes are not limited to being practiced using the Internet. In addition, and rather than WAN **150**, local area network **136** could be used in place of WAN **150**.

In the exemplary embodiment, any authorized individual having a workstation **154** can access system **122**. At least one of the client systems includes a manager workstation **156** located at a remote location. Workstations **154** and **156** are personal computers having a web browser. Also, workstations **154** and **156** are configured to communicate with server system **112**. Furthermore, fax server **128** communicates with remotely located client systems, including a client system **156** using a telephone link. Fax server **128** is configured to communicate with other client systems **138**, **140**, and **142** as well.

FIG. **3** illustrates an exemplary configuration of a user computer device **202** operated by a user **201**. User computer device **202** may include, but is not limited to, client systems **114**, **115**, **138**, **140**, and **142**, **146**, POS terminal **118**, workstation **154**, and manager workstation **156** (shown in FIG. **2**).

User computer device **202** includes a processor **205** for executing instructions. In some embodiments, executable instructions are stored in a memory area **210**. Processor **205** may include one or more processing units (e.g., in a multi-core configuration). Memory area **210** is any device allowing information such as executable instructions and/or other data to be stored and retrieved. Memory area **210** may include one or more computer readable media.

User computer device **202** also includes at least one media output component **215** for presenting information to user **201**. Media output component **215** is any component capable of conveying information to user **201**. In some embodiments, media output component **215** includes an output adapter such as a video adapter and/or an audio adapter. An output adapter is operatively coupled to processor **205** and operatively couplable to an output device such as a display device (e.g., a liquid crystal display (LCD), organic light emitting diode (OLED) display, cathode ray tube (CRT), or "electronic ink" display) or an audio output device (e.g., a speaker or headphones).

In some embodiments, user computer device **202** includes an input device **220** for receiving input from user **201**. Input device **220** may include, for example, a keyboard, a pointing device, a mouse, a stylus, a touch sensitive panel (e.g., a touch pad or a touch screen), a gyroscope, an accelerometer, a position detector, or an audio input device. A single component such as a touch screen may function as both an output device of media output component **215** and input device **220**.

User computer device **202** may also include a communication interface **225**, which is communicatively couplable to a remote device such as server system **112**. Communication interface **225** may include, for example, a wired or wireless network adapter or a wireless data transceiver for use with a mobile phone network (e.g., Global System for Mobile communications (GSM), 3G, 4G or Bluetooth) or other mobile data network (e.g., Worldwide Interoperability for Microwave Access (WIMAX)).

Stored in memory area **210** are, for example, computer readable instructions for providing a user interface to user **201** via media output component **215** and, optionally, receiving and processing input from input device **220**. A user interface may include, among other possibilities, a web browser and client application. Web browsers enable users, such as user **201**, to display and interact with media and other information typically embedded on a web page or a website from server system **112**. A client application allows user **201** to interact with a server application from server system **112**.

FIG. **4** illustrates an exemplary configuration of a server computer device **301** such as server system **112** (shown in FIGS. **1** and **2**). Server computer device **301** may include, but is not limited to, database server **116**, transaction server **124**, web server **126**, fax server **128**, directory server **130**, and mail server **132**.

Server computer device **301** includes a processor **305** for executing instructions. Instructions may be stored in a memory area **310**, for example. Processor **305** may include one or more processing units (e.g., in a multi-core configuration).

Processor **305** is operatively coupled to a communication interface **315** such that server computer device **301** is capable of communicating with a remote device such as user computer device **202** or another server computer device **301**. For example, communication interface **315** may receive requests from user computer device **114**, **115** via the Internet, as illustrated in FIGS. **1** and **2**.

Processor **305** may also be operatively coupled to a storage device **134**. Storage device **134** is any computer-operated hardware suitable for storing and/or retrieving data. In some embodiments, storage device **134** is integrated in server computer device **301**. For example, server computer device **301** may include one or more hard disk drives as storage device **134**. In other embodiments, storage device **134** is external to server computer device **301** and may be accessed by a plurality of server computer devices **301**. For example, storage device **134** may include multiple storage units such as hard disks or solid state disks in a redundant array of inexpensive disks (RAID) configuration. Storage device **134** may include a storage area network (SAN) and/or a network attached storage (NAS) system.

In some embodiments, processor **305** is operatively coupled to storage device **134** via a storage interface **320**. Storage interface **320** is any component capable of providing processor **305** with access to storage device **134**. Storage interface **320** may include, for example, an Advanced Technology Attachment (ATA) adapter, a Serial ATA (SATA) adapter, a Small Computer System Interface (SCSI) adapter, a RAID controller, a SAN adapter, a network adapter, and/or any component providing processor **305** with access to storage device **134**.

Memory areas **210** and **310** may include, but are not limited to, random access memory (RAM) such as dynamic RAM (DRAM) or static RAM (SRAM), read-only memory (ROM), erasable programmable read-only memory (EPROM), electrically erasable programmable read-only memory (EEPROM), and non-volatile RAM (NVRAM). The above memory types are exemplary only, and are thus not limiting as to the types of memory usable for storage of a computer program.

FIG. **5** illustrates an exemplary configuration of a service system **400** in accordance with the present invention. System **400** is similar to systems **100** and **122** (shown in FIGS. **1** and **2**). In the example embodiment, system **400** includes a service provider computer system **402** such as SP server system **112** (shown in FIGS. **1** and **2**), a developer computer device **404** such as developer computer device **114** (shown in FIGS. **1** and **2**), a merchant computer device **406** such as user computer device **115** (shown in FIGS. **1** and **2**), and a consumer computer device **408** such as user computer device **115** (shown in FIGS. **1** and **2**).

Developer computer device **404** includes a processor for executing instructions. Instructions may be stored in a memory area. The memory area may also include one or more developer applications **410**. Applications **410** include computer-implemented instructions that cause a computer device to interact with another computer device. For example, a developer may create an application **410** for locating ATMs included within a network of ATMs serviced by the SP (referred to as the "ATM Locator App"). The ATM Locator App can be stored within the memory area for use by computer device **404**. Developer computer device **404** is in communication with SP computer system **402** through a developer portal **420**, and through a developer sandbox platform **430**. As explained below in greater detail, sandbox platform **430** is a test platform provided by SP computer system **402** that enables a developer to test its applications with test data before such applications are rolled out for processing live production data.

SP computer system **402** includes API portal **420**, memory device **422**, sandbox platform **430**, API platform **432**, certificate signing server **434**, API services wrapper **436**, and SO computer systems **438**.

API portal **420** is configured to communicate with developer computer device **404**, and facilitates managing developer registration and login with system **402**. API portal **420** also enables developer computer device **404** to communicate with API platform **432**. API portal **420** communicates with memory device **422** to facilitate a login by a developer.

API platform **432** includes a registration service **450** that is used to register developers and developer applications **410** with SP computer system **402**. Registration service **450** is in communication with certificate signing server **434**. API platform **432** also includes an API gateway proxy **452**.

API platform **432** is in communication with API services wrapper **436**. API services wrapper **436** includes wrappers **454** for each service application **456** provided by an SO within SP computer system **402**. Service applications **456** are stored at SO computer systems **438**. SO computer systems **438** are in communication with API platform **432** through API services wrapper **436** or may be connected directly with API platform **432** without a wrapper.

Continuing with the ATM Locator App example from above, SO computer devices **438** may include a service application **456** that includes data showing a location of each of the ATM machines included within the network serviced by the SP (referred to as the "ATM Locator Service"). In this example, the ATM Locator App, which is stored on developer computer device **404**, is able to communicate with SO computer device **438** through API platform **432** and API services wrapper **436** by developer computer device **404** sending a data request to SO computer device **438**, and by receiving a data response back from SO computer device **438**. Developer computer device **404** is then able to display the location of all the ATMs within the SP network or at least some of the ATMs within the network.

Merchant computer device **406** and consumer computer device **408** each include a processor for executing instructions. Instructions may be stored in a memory area. The memory area may also include one or more developer applications **410** downloaded from developer computer device **404** for use by the merchant, consumer, acquirer, and/or issuer (collectively a "user"). In other words, a developer may develop an application that can be used by a user on their computer devices (e.g., a POS device, a personal computer, smart phone or PDA). The user downloads the application from the developer to their computer device for use by the user. When the user uses developer application **410**, merchant and/or consumer computer devices **406**, **408** communicate with SP computer system **402** through API platform **432**. Continuing with the ATM Locator App example from above, the user can download the ATM Locator App from developer computer device **404**. Consumer computer device **408** is then able to communicate with SO computer devices **438** through API platform **432** and API services wrapper **436** by sending a data request to SO computer devices **438**, and by receiving a data response back from SO computer devices **438**. Consumer computer device **408** is then able to display the location of all the ATMs within the SP network or at least some of the ATMs with the network.

As discussed above, SP computer system **402** includes a developer sandbox platform **430**, which enables a developer to test its applications with test data before such applications are rolled out for processing live production data. Sandbox platform **430** includes a copy **460** of API gateway proxy **452**, a copy **462** of API services wrapper **436**, and simulator computer devices **464** which are configured to simulate SO computer devices **438**. Sandbox platform **430** includes test data that allows a developer to test its applications **410** prior to rolling out applications **410** for production use.

In the example embodiment, a developer visits a web portal, referred to as API portal **420**, designed specifically for SP computer system **402**. At the home page, developers will be prompted to register with API platform **432**. The registration process will collect, and authenticate as required, the following data elements from the developer: first name, last name, username, password, email address, country, street address, city, state/province, postal code, phone number, and company/university affiliation. Additionally, as a condition of registration, developers must opt-in to the program by affirmatively consenting to the terms and conditions and privacy notice. API portal **420** also includes a mechanism for the developers to request access to their information in the event that they desire to change, modify or delete such information.

Once registered and authenticated, developers can log into API portal **420** and access a variety of information regarding the various service applications **456** (e.g., service offerings such as payments, locators, offers, MATCH, etc.). Each service application **456** will have its own page(s) dedicated to describing the business requirements and specifications for that service in a format easily understood by non-industry developers.

Additionally, the developers will be able to log into API portal **420**, register a key alias and request a sandbox key. The sandbox key allows developer's applications to access sandbox platform **430**, which is an environment where developers can test and validate messages using service simulators **464**.

Once a developer has been given a sandbox key, the developer can return to API portal **420** at any time and request a production key. A production key and client ID will be issued for the key alias used by the developer in the developer application. The client ID will identify which key alias is using API platform **432** to process messages and the developer that owns the production key. In the example embodiment, sandbox and production keys are not intended to be transferable or shared.

For every message that API platform **432** processes, the following will be logged: message request type; date and time received; path (message URL); IP address of sender; user agent of sender (name of sending application like IE, Firefox, or a different name); process time; and success or fail. If fail then, error information; client ID; key alias; user ID (system generated ID for developer account that owns the client ID); and unique message ID. There may be additional data elements collected based on the differing requirements of the various API service offerings. For example: for payments that have a merchant, a merchant ID will be logged in addition to the elements listed above.

In the example embodiment, a developer is required to register with SP computer system **402** to access certain information. However, an unregistered developer is able to access some information within SP computer system **402**. For example, an unregistered developer can: review available API information, documentation and sample code; access certain functions; and access community pages and read forums. However, an unregistered developer cannot: post forum comments or blogs; create a key alias; or request a sandbox or production key.

API portal **420** provides a mechanism for developers to learn about the services that are available. They have the ability to: register; communicate with other developers via the forums; request keys for sandbox (testing) and production environments; view their personal dashboard; and view metrics on transactions for each key alias they have created. The keys provide message security between the developers and SP computer system **402**.

SP computer system **402** allows a developer to interact with API sandbox platform **430**. The developer uses sandbox platform **430** for testing and validating applications **410** by using simulators **464**. The messages sent by developer applications **410** to API gateway proxy copy **460** are verified with a key. The key verifies that the message was not tampered with between the sender and SP computer system **402**. The transaction in the message is authenticated by the backend simulator computer devices **464**. The following data elements are collected from the developer during the sandbox key request process: (1) Key Alias: This is the alias the developer assigns to the key. It is used to present a user friendly identifier of the key on the dashboard. The dashboard is a web page on the portal website with the purpose of automatically displaying important information, objects, etc. (2) Description: The description of the key. It is assigned by the developer. Used on the dashboard to present the developer with a description of the key. (3) Use: This identifies if the key is for personal or commercial use. Personal use is an individual that intents to personally use or give to others for their personal use without charge. Commercial use is an individual that is developing for use by their employer or an individual that intends to sell their application to others. (4) Notes: This is free form notes that the developer can associate with the key. (5) Calls: This is the expected number of calls using the production key. It is assigned by the developer. Used by the SP for capacity planning (6) Profitable: This identifies if the developer intends the key to be used to generate a profit. It is assigned by the developer. (7) Certificate: The SP signs the certificate and makes it available to the developer on the dashboard to download. The developer sandbox key is valid for testing all available API service applications with general access and any premium services that the developer, key alias and client ID have an approved production key.

SP computer system **402** assigns a production key to a developer. During this phase, the developer will be assigned a production key number and that key number will be provided to SP computer system **402** during each call. SP computer system **402** will use the production key number to control access and track developer activity throughout the process. In the example embodiment, an existing key alias and sandbox key are required prior to requesting a production key. The following data elements are collected from the developer during the production key request process: (1) Certificate: SP computer system **402** signs the certificate and makes it available to the developer on the dashboard to download. (2) Production Services Requested This is a request for which services the production key will be valid.

A developer is able to engage a customer of the SP. The developer can build applications **410** for any of SP's business partners, including merchants, issuers, acquirers, or any other party in the SP network. The following examples describe a developer building a developer application **410** for a merchant user (the user could also be an individual, an acquirer, a processor or an issuer). The developer may be working directly for a merchant or for themselves to sell their application **410** to a merchant. The roles of the developer and merchant are separate. The SP does not have to be part of the relationship between the developer and the merchant. In some embodiments, the merchant may be required to have a relationship with the service application **456** being used, e.g. MiGS (MasterCard Internet Gateway System). The merchant and merchant acquirer would need to be registered with MiGS and have the credentials to prove that relationship is valid prior to using API platform **432**.

In the example embodiment, the SP has a trust relationship with an existing merchant. The messages sent by merchant computer device **406** using developer application **410** to API gateway proxy **452** are verified with a key (public and private key). The key verifies that the message was not tampered with between the sender and API platform **432**. The transaction in the message is authenticated by the backend service application **456**. During this phase, customer authentication is managed by the SO of service application **456** being called.

In the example embodiment, SP computer system **402** includes a certificate signing request (CSR) and a key generation process. This process is started by the developer after registration on API portal **420**. The keys/certificates are generated by the developer outside of SP computer system **402** with open source tools (like Open SSL). The SP does not own the developer's private or public key. A developer could theoretically use the same key with multiple open API's or programs not just the open API of the SP. The developer owns their private key, public key and CSR (Certificate Signature Request). The basic steps in the process are as follows: (1) the developer uses an open source tool and requests a CSR; (2) the tool provides a private and public key pair, and the public key is included in the CSR; (3) the developer uploads the CSR which contains the public key to API platform **432**; (4) API platform **432** assigns a client ID and signs the developer's public key, wherein the combination of the client ID and the signed developer's public key comprises the production key; (5) the developer then uses the client ID (which is included in the production key) in each message sent to API platform **432** that is digitally signed with the private key on developer's computer device **404**; (6) API platform **432** uses the client ID to identify which public key to use to verify the private key used to sign the message. Tools used to create keys and a CSR typically ask the developer to enter the following information when creating a CSR and key pair: name, organization, organizational unit, city, state or province, and country.

FIG. **6** is a schematic block data flow diagram illustrating a Hypertext Transfer Protocol Secure (HTTPS) Representational State Transfer (REST) service call in accordance with an exemplary embodiment of the present invention. In the exemplary embodiment, the HTTPS REST service call is made in an open API system from a client such as, but not limited to, a user of a programmed application making the call, a merchant, and a developer. In the exemplary embodiment, a computer system such as, but not limited to, service system **100** is configured to propagate a client identity in a service call from a gateway system **602** to a target service system **604** in a service provider (SP) computer system for an API service application stored within a service owner (SO) computer device. Gateway system **602** is configured to limit access to service system **100** to only authorized or identifiable users using for example, a username and password and to determine that received messages have not been tampered with. Target service system **604** is configured to receive a request for a service, which may require the identity of the requester to fulfill.

Service system **100** receives, from a third party end user **606**, a message defining an API service request that includes at least a header portion **608** and a payload portion **610**. The message may be in the form of a HTTPS REST service call. Gateway system **602** may be configured to determine an identity of an application transmitting the received message using identity information contained in header portion **608**. The identity information identity represents at least one of an entity responsible to the SP computer system for the application, a merchant, and an application user and has already been established within gateway system **602** using an identity module **612**. Gateway system **602** digitally signs the identity information wherein the security information used in the digital signature is pre-established with target service system **604**. The information that is digitally signed may also include security authorization and profile information related to the identified entity. For example, preferences as to how the response is to be transmitted back to the requester, such as by email, may be included in a profile specific to the identified requester. Additional profile information may also be included that relates to preferences of the developer, merchant or other entity.

The identity information and the corresponding digital signature may be paired in a new header **613** of a request message **614** to be transmitted from gateway system **602** to service system **604**. A name of the new request message header **613** is pre-established with the service system **604**. Target service system **604** receives request message **614** and extracts the identity information and corresponding digital signature from new header **613** and validates the corresponding digital signature. For signatures that are successfully validated, target service system **604** constructs a data structure that represents the original identity established in the gateway system using the corresponding identity information.

The term processor, as used herein, refers to central processing units, microprocessors, microcontrollers, reduced instruction set circuits (RISC), application specific integrated circuits (ASIC), logic circuits, and any other circuit or processor capable of executing the functions described herein.

As used herein, the terms "software" and "firmware" are interchangeable, and include any computer program stored in memory for execution by processor **205**, including RAM memory, ROM memory, EPROM memory, EEPROM memory, and non-volatile RAM (NVRAM) memory. The above memory types are exemplary only, and are thus not limiting as to the types of memory usable for storage of a computer program.

As will be appreciated based on the foregoing specification, the above-described embodiments of the disclosure may be implemented using computer programming or engineering techniques including computer software, firmware, hardware or any combination or subset thereof, wherein the technical effect is propagating a client identity in a service call from a gateway system to a target service system in a service provider (SP) computer system, providing to a service system a signed certificate and identity for each request message requesting services, and providing client profile information to the service system to permit additional features to be incorporated into the response. Any such resulting program, having computer-readable code means, may be embodied or provided within one or more computer-readable media, thereby making a computer program product, i.e., an article of manufacture, according to the discussed embodiments of the disclosure. The computer-readable media may be, for example, but is not limited to, a fixed (hard) drive, diskette, optical disk, magnetic tape, semiconductor memory such as read-only memory (ROM), and/or any transmitting/receiving medium such as the Internet or other communication network or link. The article of manufacture containing the computer code may be made and/or used by executing the code directly from one medium, by copying the code from one medium to another medium, or by transmitting the code over a network.

The above-described embodiments of a method and system of propagating a client identity in a service call from a gateway system to a target service system in a service provider (SP) computer system provides a cost-effective, secure, and reliable means for providing to a service system a digital signature and identity for each request message requesting services, and providing client profile information to the service system to permit additional features to be incorporated into the response.

This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims.

The invention claimed is:

1. A computer system for securely propagating an identity included in a service call request message for an open Application Programming Interface (API) service application from a first service system to a target service system in a service provider (SP) computer system, the service application stored within a service owner (SO) computer device, the SO computer device associated with a SO, the computer system comprising:

a memory device for storing data; and

a service provider (SP) computer system comprising a processor and an open application programming interface (API) platform, the SP computer system in communication with the memory device and the SO computer device, said SP computer system programmed to:

receive a first request message from an entity outside of the SP computer system, at the first service system, the first request message defining an API service request comprising a header portion and a payload portion;

determine, by the first service system, identity information to be transmitted to the target service system, the target system within the SP computer system, the identity information identifying a source outside of the SP computer system of the received message;

construct a data structure that contains the identity information and is able to be digitally signed;

receive, from the target service system, signature information for creating a digital signature;

digitally sign the identity information wherein the signature information used in the creation of the digital signature is pre-established with the target service system;

pair the identity information and the corresponding digital signature in a header of a second request message to be transmitted from the first service system to the target service system;

receive by the target service system the second request message and extract the identity information and corresponding digital signature from the header;

validate by the target service system the corresponding digital signature; and

for signatures that are successfully validated, construct using the corresponding identity information a data structure that represents the original identity established in the first service system.

2. A computer system in accordance with claim **1**, wherein the received first request message comprises an HTTP message defining the API service request.

3. A computer system in accordance with claim **1**, wherein the identity information represents at least one of a message source computer system, an application, an organization and a user.

4. A computer system in accordance with claim **1**, wherein the data structure used to represent the identity information takes the form of a string of text, XML or SAML.

5. A computer system in accordance with claim **1**, wherein the first service system is programmed to pair the identity information and the corresponding signature in an HTTP header of the request message to the target service system wherein a name of the HTTP request message header is pre-established with the target service system.

6. A computer system in accordance with claim **1**, wherein the service provider computer system is programmed to determine that the received first request message has not been tampered with.

7. A computer system in accordance with claim **1**, wherein signature information used in the construction of the digital signature comprises a public/private key certificate pre-established with the target service system.

8. A computer system in accordance with claim **1**, wherein the identity information that is digitally signed comprises profile information related to an identified entity.

9. A computer system in accordance with claim **8**, wherein the profile information related to the identified entity comprises application user profile information.

10. A computer system in accordance with claim **8**, wherein the profile information related to the identified entity comprises application developer profile information.

11. A computer system in accordance with claim **8**, wherein the profile information related to the identified entity comprises merchant profile information.

12. A computer system in accordance with claim **8**, wherein the profile information related to the identified entity comprises security authorization information, including security roles or groups.

13. A computer system in accordance with claim **1**, wherein the target service system provides access to data or logic as a service.

14. A computer system in accordance with claim **1**, wherein the identity information and corresponding digital signature are stored in separate HTTP headers within an HTTP request message.

15. A computer system in accordance with claim **14**, wherein the first service system is programmed to store the identity information and the corresponding signature in separate HTTP headers of the HTTP request message to the target service system wherein the names of the HTTP request message headers are pre-established with the target service system.

16. A computer system in accordance with claim **1**, wherein the first service system communicates more than one identity to the target service system within a single second request message.

17. A computer system in accordance with claim **16**, wherein the first service system uses separate HTTP headers for communication of each pair of identity information and corresponding digital signature.

18. A computer system in accordance with claim **17** wherein the first service system uses separate public/private key certificates to digitally sign each set of identity information.

19. A computer-implemented method of propagating a client identity included in a service call from a gateway system to a target service system in a service provider (SP) computer system, said method comprising:

receiving, at the gateway system from an entity outside of the SP computer system, a message defining an Application Programming Interface (API) service request comprising at least a header portion and a payload portion;

determining at the gateway system an identity of an application outside of the SP computer system transmitting the received message using identity information contained in the header portion that has already been established within the gateway system;

receiving, from the target service system, signature information configured to be used in the creation of a digital signature, the target system within the SP computer system;

digitally signing the identity information wherein signature information used in the digital signature is pre-established with the target service system;

pairing the identity information and the corresponding digital signature in a header of a request message to be transmitted from the gateway system to the target service system;

receiving by the target service system the request message and extracting the identity information and corresponding digital signature from the header;

validating by the target service system the corresponding digital signature; and

for signatures that are successfully validated, constructing using the corresponding identity information a data structure that represents the original identity established in the gateway system.

20. A method in accordance with claim **19**, wherein receiving a message defining an API service request comprises receiving an HTTP message defining an API service request.

21. A method in accordance with claim **19**, wherein pairing the identity information and the corresponding signature in a header of a request message to be transmitted from the gateway system to the target service system comprises pairing the identity information and the corresponding signature in a header of a request message wherein a name of the request message header is pre-established with the target service system.

22. A method in accordance with claim **19**, further comprising determining that the received message has not been tampered with.

23. One or more computer-readable non-transitory media comprising a computer-executable program that instructs at least one processor to propagate a client identity included in a service call from a first service system to a target service system for an Application Programming Interface (API) service application stored within a service provider (SP) computer system through an open API platform, said computer-executable program comprising at least one code segment that instructs the at least one processor to:

receive, from the first service system from an entity outside of the SP computer system, a message defining an API service request comprising at least a header portion and a payload portion;

determine at the first service system an identity of an application outside of the SP computer system transmitting the received API service request message using identity information contained in the header portion that has already been established within the first service system;

receive, from the target service system, signature information configured to be used in the creation of a digital signature, the target system within the SP computer system;

digitally sign the identity information wherein signature information used in the digital signature is pre-established with the target service system;

pair the identity information and the corresponding digital signature in a header of a request message to be transmitted from the first service system to the target service system;

receive by the target service system the API service request message and extract the identity information and corresponding digital signature from the header;

validate by the target service system the corresponding digital signature; and

for signatures that are successfully validated, construct using the corresponding identity information a data structure that represents the original identity established in the first service system.

24. A computer-readable non-transitory media in accordance with claim **23**, wherein the received message comprises an HTTP message defining the API service request.

25. A computer-readable non-transitory media in accordance with claim **23**, wherein the identity represents at least one of an entity responsible to the SP computer system for the application, a merchant, and an application user.

26. A computer-readable non-transitory media in accordance with claim **23**, wherein the at least one code segment instructs the at least one processor to pair the identity information and the corresponding signature in a header of the request message wherein a name of the request message header is pre-established with the target service system.

27. A computer-readable non-transitory media in accordance with claim **23**, wherein the at least one code segment instructs the at least one processor to determine that the received message has not been tampered with.

28. A computer-readable non-transitory media in accordance with claim **23**, wherein information used in the digital signature comprises a certificate pre-established with the target service system.

29. A computer-readable non-transitory media in accordance with claim **23**, wherein information used in the digital signature comprises profile information related to the identified entity.

30. A computer-readable non-transitory media in accordance with claim **29**, wherein the profile information related to the identified entity comprises application user profile information.

31. A computer-readable non-transitory media in accordance with claim **29**, wherein the profile information related to the identified entity comprises application developer profile information.

32. A computer-readable non-transitory media in accordance with claim **29**, wherein the profile information related to the identified entity comprises merchant profile information.

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